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WORLD INTELLECTUAL PROPERTY
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International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER

NO 9607250A1

(51) International Patent Classification ⁶ :

H04B 7/26

A1

(11) International Publication Number:

WO 96/07250

(43) International Publication Date:

7 March 1996 (07.03.96)

(21) International Application Number: PCT/SE95/00849

(22) International Filing Date: 12 July 1995 (12.07.95)

(30) Priority Data:

9402769-5

19 August 1994 (19.08.94)

SE

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(81) Designated States: AU, US, European patent (AT, BE, CH,
DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

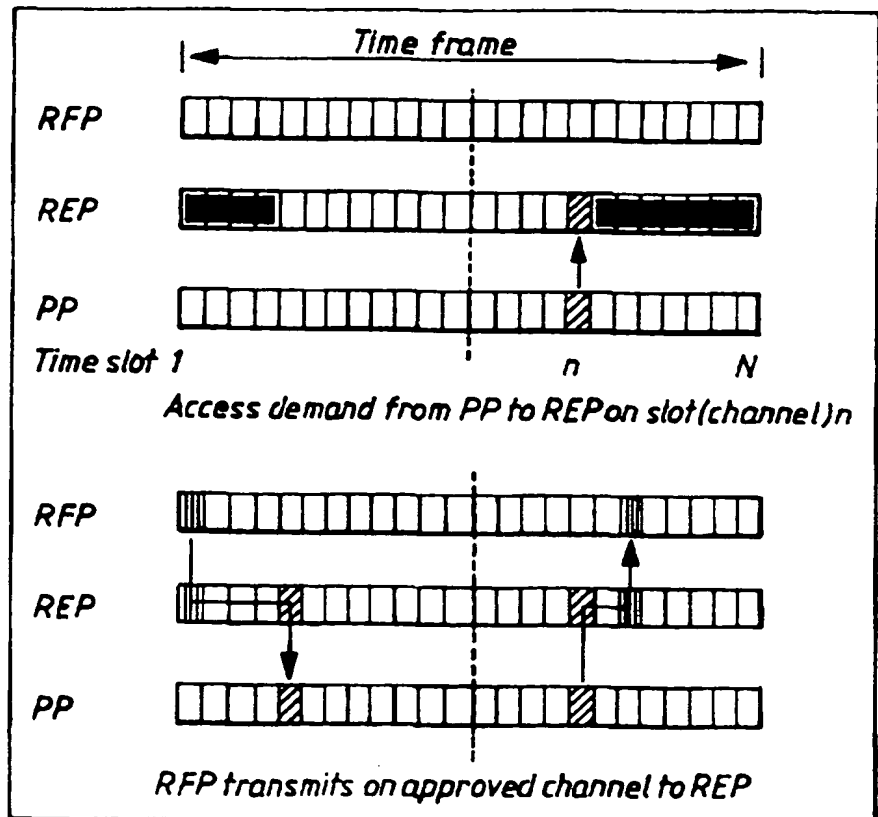
With international search report.

*Before the expiration of the time limit for amending the
claims and to be republished in the event of the receipt of
amendments.*

(54) Title: DEVICE AND METHOD IN RADIO BASED TELECOMMUNICATION SYSTEM USING REPEATERS

(57) Abstract

In a radio based system are included stationary units and portable or mobile units and in the communication between these are arranged repeaters. Respective mobile unit follows one for the used communication system normal access schedule where transmitting and receiving functions are separated in time, for instance with a half time frame. Reception for respective current stationary unit is delayed a number of time slots in relation to transmitting from the stationary unit, at which the stationary unit is aware of the delay and consequently the use of a repeater. Significant for the invention is among other things that repeating is arranged to be performed within one time frame.



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TITLE OF THE INVENTIONDEVICE AND METHOD IN RADIO BASED TELECOMMUNICATION
SYSTEM USING REPEATERS

5

TECHNICAL FIELD

It will be referred to the introductions in the
10 following patent claim for device and method
respectively.

STATE OF TECHNOLOGY

15

Repeaters in radio based communication systems can for
many applications be of very great importance for the
economy and functionality of the system. Example of a
powerful repeater application is the radio based local
20 network application OMA (Områdesbegränsad Mobil Access =
Area Restricted Mobile Access). The application implies
that the terminating wire connection to the subscriber
is replaced or completed by surface covering radio. The
subscriber is offered terminal mobility within one or
25 more restricted areas. If repeaters are used the numbers
of base units can be reduced by a factor of 10-100,
resulting in that the costs for among other things the
wire connection of base units are dramatically reduced.
Repeaters can consequently be of great importance in
30 future systems.

The importance of repeaters has led to that DECT-
repeaters are at present being standardized within ETSI
RES-3.

35

DESCRIPTION OF THE INVENTION

TECHNICAL PROBLEM

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Compared with previous proposals within the field there is a need for refining and further development to meet the demands which have lately arisen in connection with an ever increasing concentration on repeaters.

10

The invention is based on the knowledge that, for avoiding serious delays, repeating must be performed within one time frame. The invention solves certain technical problems which occur at repeating within one

15

time frame:

- How hand over within or between cells respectively and between cells is made possible.

20

- How interference between repeaters are avoided in spite of all repeaters having access to all channels.

25

- How the use of capacity demanding double duplex communication between repeaters and base station are avoided without the need of separating repeating of the control signalling and useful data in different time frames.

30

- How optimal selection of channels can be performed in spite of the portable not "hearing the base station".

- How one, regarding portables, avoids influencing present DECT-specification.

35

THE SOLUTION

See characterizing parts of the subsequent patent claims.

5

ADVANTAGES

By the invention system technical advantages can be
10 achieved by repeater function. Hand over will be possible between cells and repeaters. The system can be used in radio system which use TDMA/TDD/MC. Appropriate fields of application are radio based local networks, system for wireless Privat Automatic Branch Exchanges
15 (PABX), and public access. In connection with the above mentioned may in the short run the CT-system DCT900 and DECT be used. Notice that it may be quite possible to use one and the same DCT900 or DECT-portable (PP) in all above mentioned applications.

20

Repeating is made within one time frame. One-way average delay which is added is therefore < 2.5 ms. One does not need to use two duplex connections between RFP and REP, which results in less capacity demanding systems. CRC-
25 based micro diversity is possible. Macro diversity becomes possible. The invention implies that no separation of repeating of control signalling and useful data is needed, which simplifies encryption. Repeaters have a very big economic and functional potential for
30 above mentioned systems and for coming systems using TDMA. With the invention are important problems solved for repeaters in TDMA-system.

DESCRIPTION OF FIGURES

The invention will be described below while, at the same time, is referred to enclosed drawings where

5

figure 1 shows an example of OMA with repeaters,

figure 2 shows method for establishing of duplex channels,

10

figure 3 shows a flow chart for repeating in uplink, and

figure 4 shows a flow chart for repeating in downlink.

15

DETAILED DESCRIPTION

The following abbreviations are used:

20 REP Repeater
PP Portable Part
RFP Radio Fixed Part (corresponding to base station)
ARK Access Rights Key
ARI Access Rights Identity

25

The following invention gives directives how repeating with coding/decoding of control fields can be performed in radio systems with time shared access, as for
30 instance in DECT. PP follows normal access schedule, for DECT does this imply that transmitting and receiving are separated a half time frame. Reception for RFP is, on the contrary, delayed a number of time slots in relation to transmitting for RFP.

RFP, however, must have knowledge of this delay, i.e. that REP is used. Example:

A. Set up initiated by RFP

5 Set up from RFP is performed by normal paging message. Selection of channel is performed by PP, whereupon demand for access is returned by PP on the selected channel. REP compares the selection of channel with REP channel list. If the channel
10 is not sufficiently silent, there will (see also figure 2 and 3) either be no repetition; instead PP is informed from REP that the selection of channel is not accepted. The message is sent in downlink on by PP wished channel. Or REP selects
15 another, more silent channel for the RFP-communication, such one that repetition in downlink from RFP yet can be performed on channel wished by PP. At accepted, confirmed channel selection repeating is made in uplink. REP adds
20 message to control field regarding present delay, i.e. channel for RFP>REP-communication. N.B.; if such message is lacking, RFP shall suppose that the delay is zero slots. i.e. communication is performed without REP, direct with PP.

25

B. Set up initiated by PP

Set up from PP is performed by access demand on wished channel

30 How to avoid two REP uplink repeating the same message ?

PP indicates wished RFP-identity (corresponding to FMID), geographically unique). But this RFP-id also comprise a local REP-unique addition. This addition
35 has been added in downlink by respective REP.

Possibly REP can remove the ID-addition in uplink in order not to distract RFP (see fig.3)

5 How to avoid two REP downlink repeating the same message on the same channel ?

10 The problemn does not exist for established duplex communication because REP knows which duplex channels it is managing. For simplex messages from one and the same RFP, adjacent RFP should, on the contrary, repeat on different channels for avoding interference. The selection of channel can be made in such a way that REP which receives simplex traffic shall repeat on the free channel which latest by REP carried a finished duplex. (Channel change can also be performed by REP if PP demands "change dummy bearer position") (see fig.4)

20 How to manage hand over between two REP (inter REP handover)?

25 As previously mentioned each REP indicate his local unique identity as an addition to the RFP-identity. This entails that also inter REP handover is managed - PP indicates, as we know, indirectly wished REP-id at each new access demand.

How to manage hand over between REP and RFP?

30 In the same way as inter REP hand over. PP "sees" that REP and RFP have different identities. This implies that REP will not repeat the new access demand from PP, because REP is not addressed. For RFP occurs a "normal" intra cell hand over, but in addition with a change of delay between transmission/reception.

35

Two adjacent REP can by using a common identity be used for macro diversity according to previous invention announcing. REP ought to have an access key (REP-ARK) corresponding to PARK for PP.

5

By REP comparing REP-ARK with ARI from RFP, REP can decide whether it has a right to repeat traffic from the RFP in question.

- 10 REP-id can also be used by RFP for adresssing specific REP for system updating, trouble shooting etc. I may for instancce be valuable to have opportunity to change REP-ARK for a REP. In this way can for instance operator's belonging be changed.

15

Emergency call shall be repeated independent of REP-ARK.

References are made to the figures which should be selfexplaining.

PATENT CLAIMS

1. Device at radio based telecommunication system comprising stationary units (compare base stations) and mobile units and in the communication between these arranged repeaters, c h a r a c t e r i z e d in that respective mobile unit follows one for used communication system, for instance DECT, normal access schedule, where transmitting and receiving functions are separated in time, for instance at DECT with a half time frame, that reception for respective mentioned stationary unit is delayed a number of time slots in relation to transmission from the stationary unit, at which the stationary unit has knowledge of the delay and with that the using of a repeater.

2. Device according to patent claim 1, c h a r a c t e r i z e d in that repeating with encoding/decoding of control field is arranged to be made by means of time shared access, compare the time shared access existing in DECT.

3. Device according to patent claim 1 or 2, c h a r a c t e r i z e d in that a set up, initiated by respective stationary unit, is made by conventional paging message, that each mobile unit performs selection of channel, whereupon the mobile unit returns access demand on the selected channel.

4. Device according to any of the previous patent claims, c h a r a c t e r i z e d in that respective repeater compares the selection of channel with a channel list for the repeater/repeaters.

5. Device according to any of the previous patent claims, characterized in that no repeating is performed if the channel or connection in question is not sufficiently silent, at which the repeater instead informs current mobile unit that the channel selection is not acceptable, in addition to which the mobile unit transmits the message in downlink on wished or selected channel, or that the repeater selects another, more silent channel for the stationary unit's communication, at which such repeating in downlink from the stationary unit yet can be made on wished channel by the mobile unit.

6. Device according to any of the previous patent claims, characterized in that, by accepted or adjusted channel selection repeating is performed in uplink, at which the repeater adds message in control field regarding present delay, i.e. channel for communication for the stationary unit and the repeater, in addition to which in the case when message of mentioned kind does not exist, the stationary unit assumes that the delay is zero slots, i.e. communication is performed without repeaters direct with the mobile unit.

7. Device according to any of the previous patent claims, characterized in that set up initiated by the mobile unit is performed by access demand on wished channel.

8. Device according to any of the previous patent claims, characterized in that the mobile unit indicates wished identity of the stationary unit, at which is prevented two repeaters repeating the same message.

9. Device according to any of the previous patent claims, characterized in that, at simplex-message from one and the same stationary unit, adjacent repeater repeats on different channels for avoiding interference, that the channel selection at that is arranged to be performed in a way that the repeater receiving simplex-traffic repeats on the free channel which latest by the repeater was a finished duplex, at which two repeaters do not downlink repeat the same message in the same channel.

10. Device according to any of the previous patent claims, characterized in that the hand-over function is arranged to be possible between two repeaters.

11. Device according to any of the previous patent claims, characterized in that respective repeater indicates its local unique identity by adding in the identity of the stationary unit, which implies possibilities for the hand-over function between two repeaters by the mobile unit indirectly indicating wished repeater identity at each new access demand.

12. Device according to any of the previous patent claims, characterized in that hand-over function exists between repeater and stationary unit, that the mobile unit detects that the repeater and the stationary unit have different identities, which means that the repeater will not repeat the new access demand from the mobile unit because the repeater is not addressed, and/or that for the stationary unit occurs a normal intern cell-handover and besides changing of delay/reception.

13. Device according to any of the previous patent claims, characterized in that two adjacent repeaters are arranged to use a common identity, at which macro diversity becomes possible.

14. Device according to any of the previous patent claims, characterized in that the repeater shows an access key corresponding to PARK for the mobile unit and/or by the repeater comparing REP-ARK with ARI from the stationary unit, the repeater can decide whether it has the right to repeat traffic from the stationary unit in question.

15. Device according to any of the previous patent claims, characterized in that the repeater's identity is also usable by the stationary unit for addressing specific repeater for system updating, fault finding etc, for instance for making it possible to change REP-ARK for a repeater at which also the operator category becomes possible to change.

16. Device according to any of the previous patent claims, characterized in that emergency calls are repeatable independent of REP-ARK.

17. Device at radio based communication system comprising stationary units and mobile units and in the system arranged repeaters characterized in that repeating is arranged to be performed within one time frame.

18. Method in telecommunication system using stationary and portable units and repeaters in communication between the units, characterized in that, at establishing of duplex-channel, access demand is sent from current portable unit to current repeater on a slot

(channel) n , that slots are selected by the repeater for communication with the stationary unit, that for uplink the best slot of $n+1$ to N is selected, that for downlink the best slot of 0 to $N-1-N/2$ is selected, that at
5 performed channel selection is repeated to the stationary unit from the repeater, and that in control field the stationary unit is informed of desired channel for the downlink repeating, and that the stationary unit transmits on approved channel to the repeater which
10 after that repeats to the portable unit on the channel which was indicated by the portable unit at the access demand above, at which the duplex connection is established.

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Fig-1

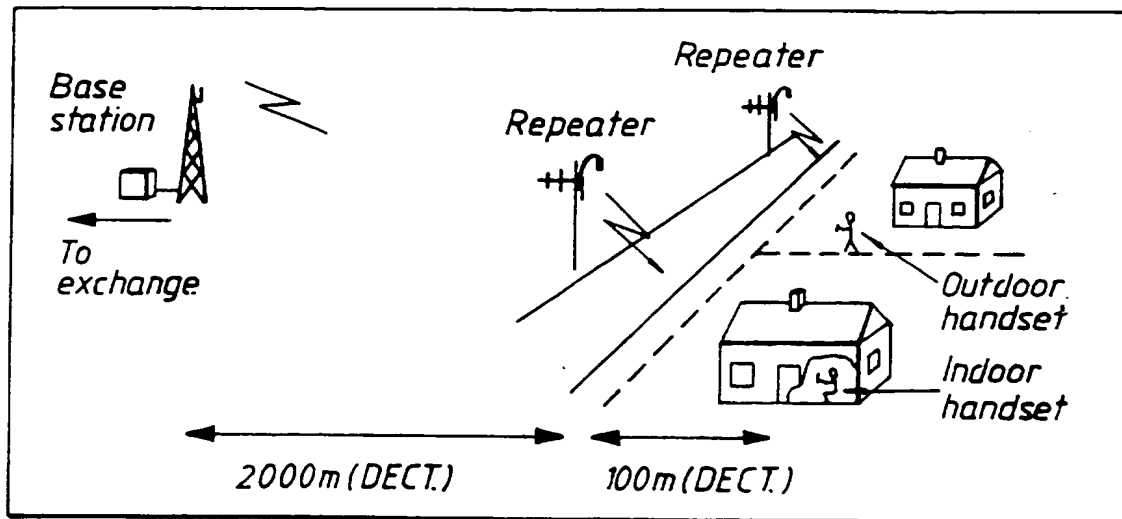
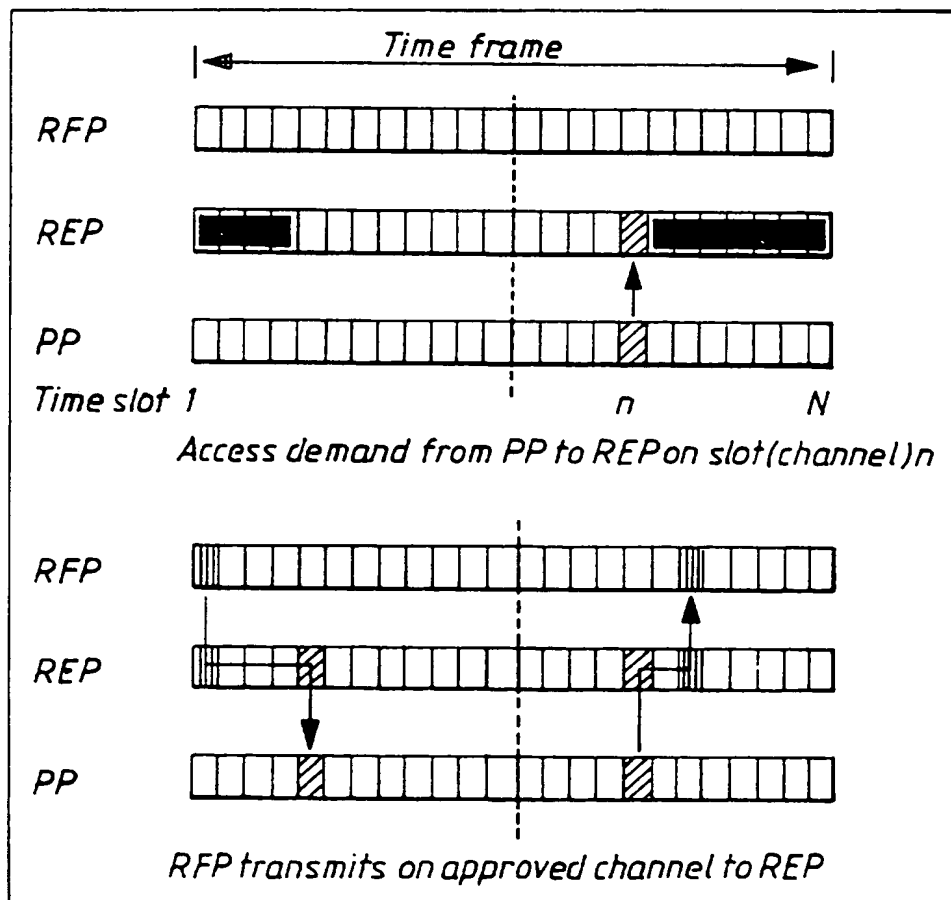
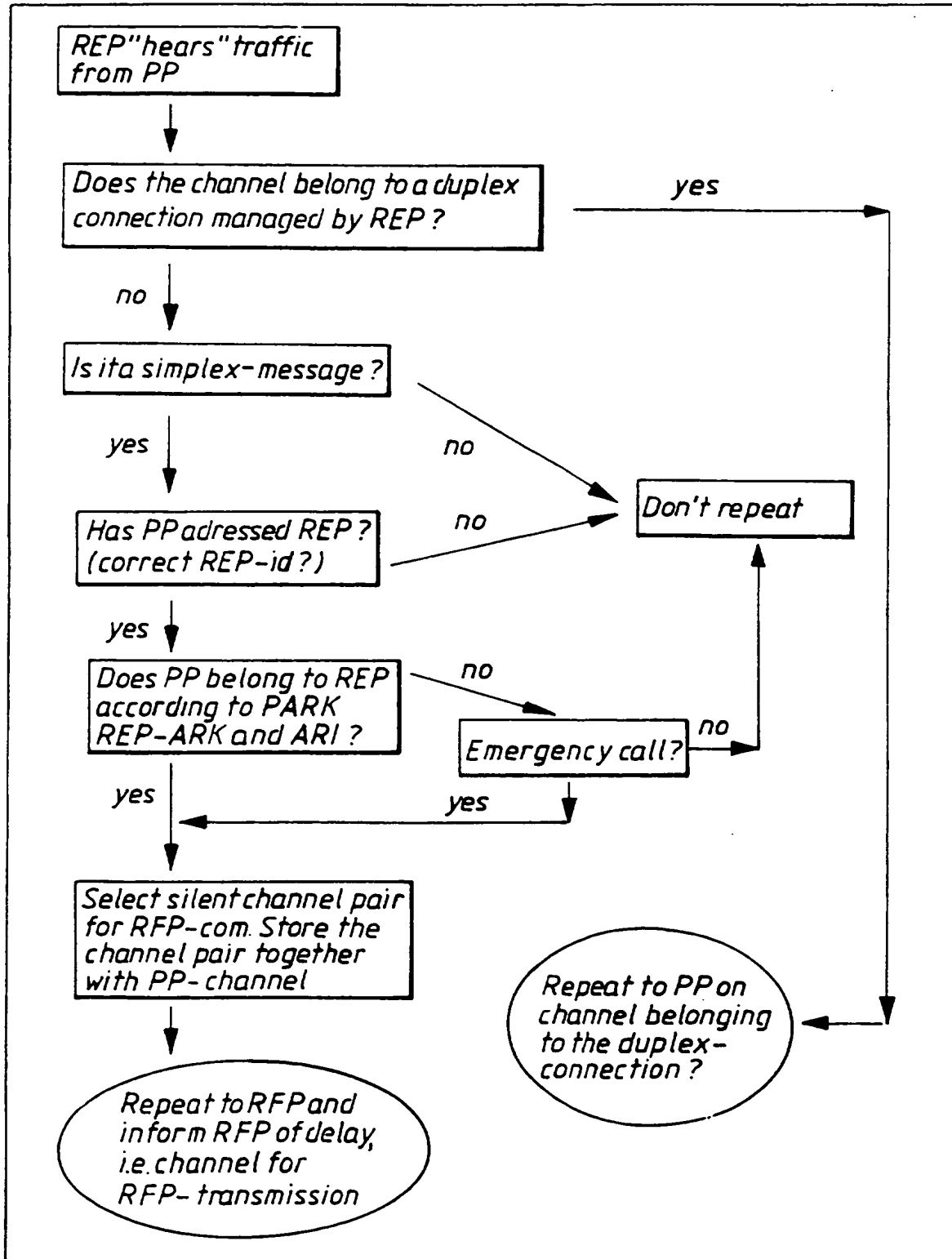


Fig-2



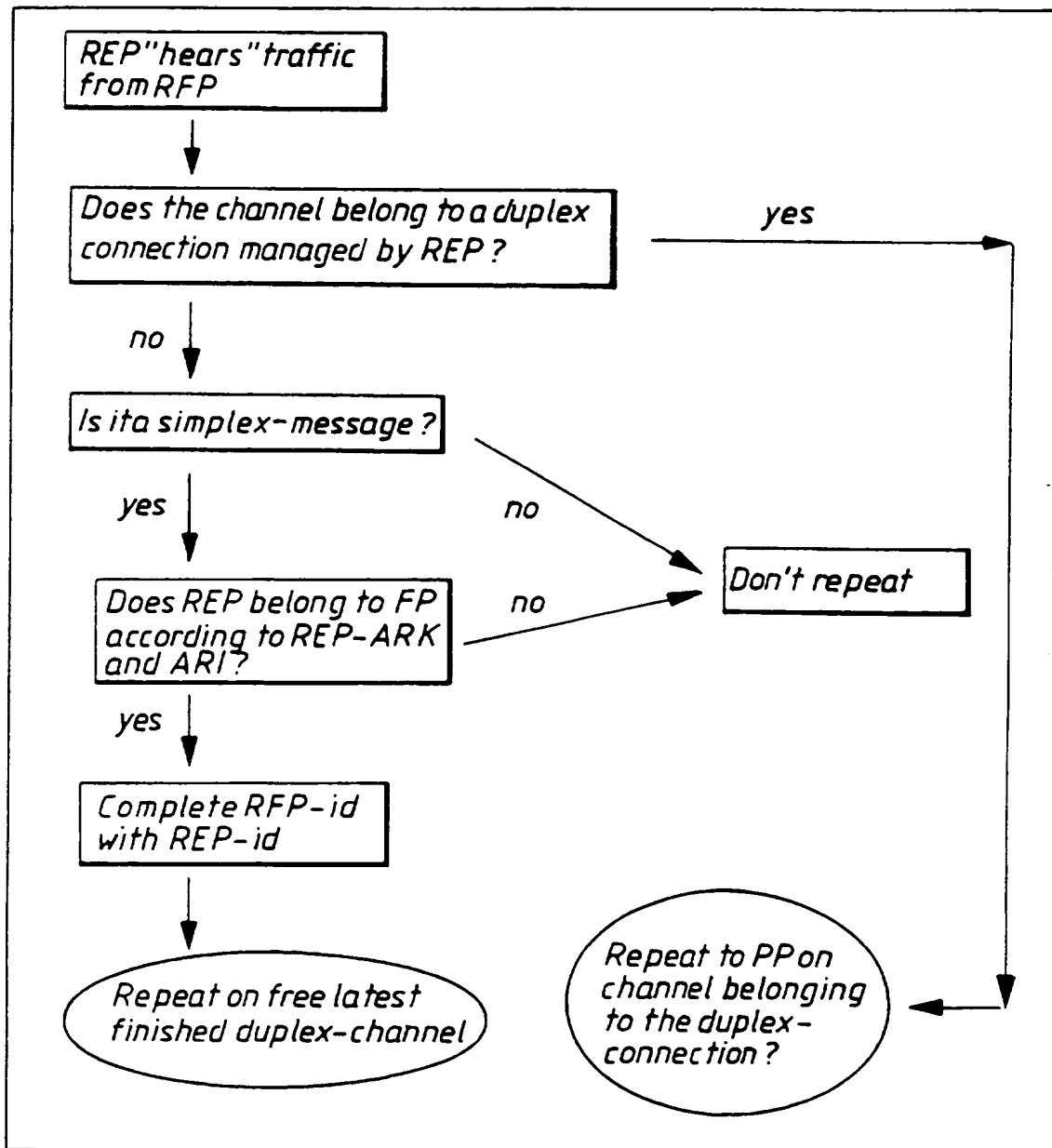
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Fig. 3



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Fig. 4

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/S.../00849

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 7/26

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
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| P,A | EP 0637144 A1 (ITALTEL SOCIETA ITALIANA TELECOMUNICAZIONI S.P.A.), 1 February 1995 (01.02.95), see whole document -- | 1-18 |
| A | US 5133080 A (JAIME A. BORRAS), 21 July 1992 (21.07.92), column 2, line 19 - line 42, abstract -- | 1-18 |
| A | WO 9417605 A1 (TELIA AB), 4 August 1994 (04.08.94), abstract -- | 1-18 |

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Information on patent family members

05/01/96

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